

**DRAFT**

AMENDMENT FOUR TO AGREEMENT BETWEEN  
THE DEPARTMENT OF WATER RESOURCES AND  
THE DEPARTMENT OF FISH AND GAME  
TO OFFSET DIRECT LOSSES IN RELATION TO  
THE HARVEY O. BANKS DELTA PUMPING PLANT

This Amendment Four including its attachments (Amendment) is made on (month) (day), 2008 between the Department of Water Resources (DWR) and the Department of Fish and Game (DFG) to amend their 1986 Agreement (Agreement) to offset direct losses of fish caused by the diversion of water by the Harvey O. Banks Delta Pumping Plant.

Recitals:

- A. On December 30, 1986, DWR and DFG entered into a California Environmental Quality Act mitigation agreement to offset direct losses of fish caused by the diversion of water at the Harvey O. Banks Delta Pumping Plant (Delta Pumping Plant). The Agreement has been known as the Four Pumps Agreement and hereinafter will be known as the Delta Fish Agreement.
- B. In Article I, Paragraph B. of the Agreement, DWR agreed to provide \$15 million to initiate a program for fishery improvement projects. Paragraph I.D.4. required the \$15 million to be expended within 10 years from the date of the Agreement. The Agreement has been amended three times to extend this period for expenditure, with the most recent extension through December 2007. As of December 2007, about \$2.3 million of the \$15 million remains unexpended for previously approved projects.
- C. The Agreement offsets direct losses of striped bass, Chinook salmon and steelhead. Paragraph B of Article V of the Agreement provides that measures to offset direct losses for fish species not covered in the original Agreement shall be included when more information is obtained to develop effective measures. It also provides for the addition of other species to the Agreement.
- D. Article VII of the Agreement directs DFG and DWR to develop ways to offset the adverse fishery impacts of the State Water Project (SWP) not addressed in the Agreement, including indirect fishery impacts.
- E. In the July 8, 2005, letter to the Director of DFG, the Director of DWR proposed expanding the scope of the Agreement to establish a separate fund to quickly address near-term pelagic fish issues related to the Pelagic Organism Decline (POD), including declining abundance of delta smelt. In the February 2, 2006, letter to the Director of DWR, DFG agreed with the proposal to fund POD studies

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and actions. A “POD and Special Mitigation Account” was set up under the Delta Fish Agreement with an initial budget of \$2.5 million. The funds are available for immediate actions to address mitigation for pelagic fish species. Mitigation actions funded under this account will not receive fish equivalent credits.

- F. On July 28, 2006, DWR and DFG, along with the California Bay-Delta Authority (CBDA), the United States Bureau of Reclamation (Reclamation), the United States Fish and Wildlife Service (USFWS), and six water agencies, entered into a *Memorandum of Agreement for Certain Ecosystem Actions and Support for Implementation of Near-Term Water Supply, Water Quality, Ecosystem, and Levee Actions* (MOA). This MOA is intended to provide funding of key programs and to further the development of the Bay Delta Conservation Plan (BDCP). The BDCP is anticipated to provide Federal Endangered Species Act (FESA) and California Endangered Species Act (CESA) compliance for coordinated SWP and Central Valley Project (CVP) operations in the Sacramento-San Joaquin River Delta through a Habitat Conservation Plan (FESA Section 10) and a Natural Community Conservation Plan (NCCP) (Fish and Game Code Section 2800 et seq.).
- G. On October 6, 2006, DWR and DFG, along with the California Resources Agency, Reclamation, USFWS, the National Marine Fisheries Service (NMFS), seven water agencies and other Delta water users, and four non-governmental organizations, signed the BDCP Planning Agreement. Consistent with the NCCP Act, the Planning Agreement recognized that the parties could “elect to preserve, enhance, or restore, either by acquisition or other means, aquatic and associated riparian and floodplain habitat in the Planning Area that support native species of fish, wildlife, or natural communities prior to approval of the BDCP” and that DFG, USFWS, and NMFS could agree, if appropriate, to “credit such resources toward the land and water acquisition or habitat protection, enhancement, and restoration requirements of the BDCP.”
- H. On May 7, 2007, DWR and DFG entered into a Memorandum of Understanding (MOU) in order to facilitate and expedite completion of the reinitiated consultation of the federal biological opinions on the coordinated SWP and CVP operations, commonly referred to as the Operations Criteria and Plan (OCAP). In Paragraph 7 of the MOU, DWR and DFG agreed to begin negotiations to amend the Agreement to “at least address direct and indirect take of delta smelt and indirect take of salmon and methods to develop mitigation credits for this take.”
- I. It is anticipated that the early implementation actions identified in Section 3 of this Amendment will be included in the Project Description for the OCAP Biological Assessment and subsequent Biological Opinions (BiOp(s)) issued by USFWS and NMFS. DWR intends to submit the revised OCAP BiOps and incidental take statements to DFG for a determination pursuant to Fish and Game Code Section 2080.1 (Consistency Determination) for the take of winter-run Chinook salmon (federally listed as “Sacramento River Winter-Run” and State listed as “Winter-

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Run”, hereinafter known as winter-run Chinook salmon), spring-run Chinook salmon (federally listed as “Central Valley Spring-Run” and State listed as “Spring-Run of the Sacramento River Drainage”, hereinafter known as spring-run Chinook salmon), and delta smelt from the Delta Pumping Plant, Clifton Court Forebay, Skinner Fish Facility, and Barker Slough Pumping Plant (collectively, SWP Delta Pumping Facilities).

- J. DFG will determine if the BiOps contain sufficient avoidance and minimization measures for winter-run Chinook salmon, spring-run Chinook salmon, and delta smelt. If so, DFG will then determine whether the mitigation actions and other measures identified in this Amendment and in the BiOps address CESA’s requirement to fully mitigate for the direct and indirect take of species.
- K. In the event longfin smelt are State listed, DFG will consider the benefits of this mitigation for longfin smelt as part of its review of any application which DWR may submit for longfin smelt take.
- L. DWR and DFG intend through this Amendment that DWR will provide further funding through subsequent agreements for DWR’s commitment to mitigation actions. Prior to implementing the mitigation actions under this Amendment, DWR and DFG will comply with all permitting and environmental requirements including the California Environmental Quality Act (CEQA).
- M. At the (insert date), 2008, Delta Fish Agreement Advisory Committee Meeting, committee members reviewed the draft of this Amendment and recommended that the 2008 Amendment be submitted to the Directors of DWR and DFG for signature.

#### DELTA FISH AGREEMENT

DWR and DFG agree to the following amendment to the Agreement:

- 1. Article I, Paragraph D.4 is amended to read:

The remainder of the \$15 million lump sum previously provided under Article I, Paragraph B of the original Agreement shall be available until December 31, 2012. The funds will be allocated as specified in Attachment 1 of this Amendment, unless otherwise agreed to by the Directors of DWR and DFG.
- 2. Article I, Paragraph D.6. is deleted.
- 3. DWR and DFG agree that SWP Delta Pumping Facilities cause direct losses of some species other than those specifically listed in the original Agreement and also cause indirect losses. Pursuant to Article V and VII, DWR will mitigate for direct and indirect losses of winter-run Chinook salmon, spring-run Chinook salmon, delta

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smelt, and longfin smelt (collectively “Fish Species”) caused by the SWP Delta Pumping Facilities in the following manner:

- A. Mitigation Actions. Mitigation for direct and indirect losses of Fish Species from SWP Delta Pumping Facilities over the term of this Amendment shall be achieved by implementing the following actions. DWR will:
  1. Provide direct and indirect benefits to the Fish Species through restoration of aquatic habitat in the Delta and Suisun Marsh to mitigate for SWP Delta Pumping Facilities impacts to surface acres of aquatic habitat in the Delta. The actual amount of habitat to be restored and/or enhanced is determined by the DFG methodology described in Attachment 4, using the area-of-effect equation  $(A(P)=E)$  described in Attachment 4, once the actual Export/Inflow ratio is determined in the OCAP BiOps issued by the USFWS and NMFS. Some of the potential actions to provide this acreage are described in Attachment 2- Sections A1 and D.
  2. Provide direct and indirect benefits to the anadromous Fish Species through funding of mitigation actions described in Attachment 2- Sections A2, B and C, or equivalent actions, as determined by DFG.
- B. Implementation Schedule. Within six months from the effective date of this Amendment, DFG and DWR shall jointly develop an implementation plan schedule (Implementation Schedule). The Implementation Schedule will identify restoration actions, costs, targeted acreage, and a timeline for DWR’s implementation over the term of this Amendment.
- C. Funding. Plans for individual mitigation actions shall include DWR funding sufficient to accomplish full implementation of the action, which may include, without limitation, restoration planning, environmental review and documentation, permitting, interim management prior to restoration, restoration implementation, operation and maintenance activities, and monitoring to evaluate project success in meeting the planned restoration objectives. DWR funding will cover DFG incurred costs necessary to plan and implement the action.
- D. Acceptance Process. DFG will use the process outlined in Attachment 3 in determining whether to accept specific proposed mitigation actions.
- E. Mitigation Options. The mitigation actions described herein will be identified by DFG and DWR with assistance from USFWS and NMFS and submitted for final acceptance by DFG. Mitigation actions will be implemented through separate approvals and could include any of the following, subject to conformance with Attachment 3:
  1. Ecosystem Restoration Program Directed Actions.
  2. Ecosystem Restoration Program Proposal Solicitation Process (PSP).

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3. DWR Sponsored Projects.
4. Purchase Credits at Mitigation Banks.
5. Cost-Share Projects.
6. Other actions mutually agreed upon by DWR and DFG.

DWR and DFG will comply with CEQA prior to implementing the mitigation actions provided under this Amendment. DWR will serve as lead agency and DFG as responsible agency unless circumstances require that a different lead agency and responsible agency be used. DWR will be responsible for all DWR and DFG costs associated with CEQA compliance commensurate with DWR's interest in the project

F. Commitments and Financing. A phased approach will be used to ensure funding and implementation of actions as set forth below:

1. Year One Commitments and Financing:

In order to immediately start mitigation to restore habitats needed to ensure sufficient nutrient production, spawning and rearing for Fish Species, during Year One DWR will fund, plan, and implement to the extent practicable, the actions specified in Attachment 2- Sections A and B, or equivalent actions accepted by DFG, at an estimated cost of \$36 million.

2. Year Two through Ten Commitments and Financing:

In Years Two through Ten, DWR will work with DFG to initiate or continue implementation of mitigation actions identified in Attachment 2- Sections B, C, and D. DWR will:

- a. Mitigate the impacts to in-Delta aquatic habitat for Fish Species by providing the amount of acreage determined pursuant to Paragraph 3. A.1. This will be achieved by securing and initiating implementation of 35% of the acreage by year four, 60% by year six, 80% by year eight and 100% by year ten, and diligently pursuing implementation to completion.
- b. Continue to fund the Ongoing Annual Mitigation Actions listed in Attachment 2- Section B that are currently funded through the existing "DWR Delta Fish Agreement Annual Account," or other annual actions mutually agreed to by DWR and DFG.
- c. Should unforeseen circumstances arise that render the timely implementation of these mitigation actions infeasible, DWR and DFG will meet and determine how to address the effects of the delay, if any.
- d. Reimburse DFG's staffing costs to plan and implement mitigation actions including, but not limited to, tracking compliance with the

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Implementation Schedule, negotiating land transfer agreements, managing transferred lands, assessing and evaluating results, and helping develop adaptive management plans. (See: Attachment 2- Section E.)

G. Acreage Credit. DWR will receive acreage credit as described in Attachment 3 upon securing acreage designated for restoration and initiating implementation of mitigation actions.

H. Property Transfer and DFG Management Costs. When DWR acquires and restores property pursuant to this Amendment, that property will be protected by a transfer from DWR to DFG through a separate agreement for each site on terms acceptable to DFG. If DFG and DWR cannot agree to terms for the property transfer, DWR shall continue to hold the property but shall allow DFG sufficient access and right to ensure operation and maintenance of the property in accordance with the approved mitigation action plan. In all cases, DWR will provide sufficient funding to DFG to provide for perpetual operation and maintenance (O&M) of the site. DFG will use these funds for staffing and conducting and/or causing to be conducted normal maintenance and operations associated with managing the lands as Wildlife Areas or Ecological Reserves.

I. BDCP Early Implementation. Consistent with the BDCP Planning Agreement, DFG agrees that the mitigation actions pursuant to this Amendment are also considered BDCP early implementation actions intended to mitigate ongoing SWP Delta Pumping Facilities impacts on Fish Species.

J. Annual Reporting. DFG and DWR shall jointly prepare an annual report on programs and projects being implemented by each department. The report will include financial reporting, the progress of each project towards meeting the intended mitigation goals and Implementation Schedule, and the current status, barriers, and relative accrued benefits of those projects.

K. Changes in Ongoing Annual Mitigation Credit. This Amendment makes the following changes to the Annual Mitigation Account:

1. The Ongoing Annual Mitigation Actions identified in this Amendment, Attachment 2- Section B, shall no longer receive fish equivalent credits for annual salmon mitigation under the Agreement. These Ongoing Actions will continue to mitigate the SWP Delta Pumping Facilities impacts to winter-run and spring-run Chinook salmon under this Amendment, and will continue to be funded through the existing “DWR Delta Fish Agreement Annual Account.” Other projects funded through the “DWR Delta Fish Agreement Annual Account” will continue to receive fish equivalent credits under the Agreement.
2. The annual DFG mitigation loss calculation provided for under Article I, Paragraph A. of the Agreement shall no longer include loss calculations for winter-run and spring-run Chinook salmon.

3. Past fish equivalent credits will not be eliminated, but past and ongoing fish equivalent credits shall not be applicable to mitigation requirements under this Amendment.
- L. Other Fish Species. Measures provided under this Amendment may benefit other fish species. To the extent that such actions benefit other fish species, DFG will consider those benefits as part of its review for any subsequent application which DWR may submit.
- M. Substantial Changes. The Delta is ever-changing with new scientific information developing, and multiple programs and/or strategic plans are expected to finalize during the term of this Amendment. DFG and DWR acknowledge new scientific information, any substantial changes affecting Fish Species, and/or DWR's impacts on Fish Species may necessitate revisions to this Amendment.
4. Controlling Language. In the event of a conflict between this Amendment and the Agreement with regard to the subject matter of this Amendment, this Amendment controls. Except as otherwise provided herein, the Agreement remains in full force and effect.
5. Withdrawal. Any party may withdraw from this Amendment with 60 days written notice and participation in the Dispute Resolution process described below. Provided however that if DWR receives one or more Consistency Determinations or permits from DFG, based in whole or in part on the measures described in this Amendment, and either later withdraws or fails to perform in accordance with the terms of this Amendment, such withdrawal or failure shall be deemed non-compliance with the terms of a permit, or may invalidate a prior Consistency Determination.
6. Dispute Resolution. In the event a dispute arises out of any term or condition of this Amendment, DFG and DWR shall meet as soon as possible to resolve the dispute. DFG and DWR shall then attempt to negotiate a resolution of such dispute. Notwithstanding the above provision, neither DFG nor DWR waive any rights or duties it may have pursuant to federal and state laws, rules, or regulations.
7. Headings. The paragraph headings in this Amendment have been inserted solely for convenience of reference and are not a part of this Amendment and shall have no effect upon its construction or interpretation.
8. Effective Date and Term. This Amendment shall become effective upon signatures below and approval by the Department of General Services, and shall continue except as otherwise provided herein. At year ten DFG will review the sufficiency and efficacy of actions undertaken and funding provided under this Amendment in achieving the desired benefits to the Fish Species. Review of mitigation actions will include the process described in Attachment 3, Section C.

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Lester A. Snow, Director  
Department of Water Resources

Date: \_\_\_\_\_

\_\_\_\_\_  
Donald Koch, Director  
Department of Fish and Game

Date: \_\_\_\_\_

Attachments:

1. \$15 Million Lump Sum Account Remaining Funds
2. Delta Fish Agreement Amendment Commitments
3. Delta Fish Agreement Evaluation, Acceptance and Progress Review of Mitigation Actions.
4. California Department of Fish and Game Rationale for Effects of Exports

**DELTA FISH AGREEMENT  
\$15 MILLION LUMP SUM ACCOUNT**

**Anticipated Allocation of Remaining Funds**

<u>PROJECTS</u>	<u>AMOUNT</u>	<u>COMPLETION DATE</u>
<b>REMAINING ALLOCATIONS UNDER AMENDMENT THREE:<sup>1</sup></b>		
Revised Deer Creek Water Exchange Project	\$ 875,000	December 2010
Suisun Marsh Fish Screen Operations and Maintenance	\$ 58,000	June 2009
Stanislaus River Spawning Habitat and Floodplain Restoration: Lover's Leap Reach	\$ 422,000	June 2008
Tuolumne River, La Grange Gravel Addition, Phase II	\$ 200,000	June 2009
Merced River Salmon Habitat Enhancement, Expanded Western Stone Sites	\$ 722,000	December 2012
Upper Western Stones Conceptual Design	\$ 26,000	December 2008
Merced River Wing Deflector Gravel Replenishment	\$ 40,000	June 2009
<b>TOTAL</b>	<b>\$2,343,000</b>	

<sup>1</sup> Funding approved, but unexpended through December 2007, including encumbrances.

Delta Fish Agreement Amendment Commitments														Attachment 2
Mitigation Actions	Mitigation Action Features	Anticipated Benefits	Status	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
SECTION A.														
Early Implementation Actions														
A1.														
Cache Slough Complex 1. Prospect Island 2. Liberty Island	1. Up to 1692 acres 2. TBD based on enhancement of existing habitat	Habitat benefits for improved estuarine processes and function to support delta smelt, longfin smelt and other Fish Species.	In Progress	\$12,000,000*	*These funds are to be expended over the first three to five years, or as determined when the projects are fully designed.									\$12,000,000
Hill Slough West Tidal Marsh Restoration	207-1100 acres	Same as above	Planning	\$8,809,000*										\$8,809,000
A2.														
Battle Creek Phase 1	Open 31.5 miles of spawning/rearing habitat	Winter/spring-run, Chinook, spawning/rearing	Planning	\$12,000,000 fixed cost										\$12,000,000
Delta Smelt Refugium Culture Facility	Expand knowledge base for delta smelt science (One-time funding contribution)	delta smelt	In Progress	\$1,500,000 one-time cost										\$1,500,000
SECTION B.														
Ongoing Annual Mitigation Actions														
a. Salmon Escapement Program \$300,000	a. Expand knowledge base for Chinook salmon	All salmon species	In progress and Ongoing	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$691,000	\$6,910,000
	b. Increase fish passage flows.	Spring-run Chinook spawning and rearing												
b. Deer Creek Water Exchange Program\$129,000	c. Increase fish passage flows.	35 miles spring-run Chinook spawning/rearing												
c. Mill Creek Exchange Water Exchange Program \$95,000	d. Support maintenance for existing screen and ladder facilities.	Protect major spring-run Chinook spawning/rearing watershed												
d. Butte Creek Fish Passage Monitoring Program \$100,000														
e. Spring-Run Warden OT \$67,000	e. Increased enforcement presence on all spring-run tributaries.	Enhanced spring-run Chinook salmon protection												
SECTION C.														
Additional Potential Anadromous Actions														
a. Lower Putah Creek Re-Alignment b. Lisbon Weir Improvements c. Tule Canal Conductivity d. Fremont Weir Fish Passage e. Yolo Bypass Floodplain Habitat f. Additional Listed Anadromous Fish Species Project Opportunities	Improved juvenile rearing, upstream passage for adult anadromous fish and downstream passage for juvenile anadromous species • Water Right purchase • Water/energy bypass purchase • Tributary restoration action • Fish passage improvements	a. Fall-run Chinook b. Passage– Chinook, sturgeon, splittail c. Passage– Chinook, sturgeon, splittail d. Passage– Chinook, sturgeon, splittail e. Spawning, rearing, and foodweb – splittail, Chinook, rearing f. TBD	Ongoing		\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$1,500,000	\$13,500,000
SECTION D.														
Additional Potential Mitigation Actions for In-Delta Acreage														
Actions in the Delta, Suisun Marsh, and Cache Slough Complex: a. Western Cache Slough Complex b. Little Holland Tract Restoration Project c. Eastern Egbert Tract Restoration Project d. Meins Landing Tidal Marsh Restoration Project	Acreage to be determined.	a. Foodweb, tidal processes, habitat b. Tidal Processes, habitat												
SECTION E.														
DFG Delta Fish Agreement Mitigation Management Account	Staff necessary to support mitigation activities. 8 PYs Total: 5 PY- Planning and Monitoring 3 PY- restoration habitat management planning & transfer agreements.	Facilitate implementation of mitigation actions.		\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$10,000,000
YEARLY SUMMATION				36,000,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$3,191,000	\$64,719,000
Percent progress towards required mitigation acreage. To Be Determined (TBD).				• TBD (up to 3000 acres)	TBD	TBD	35%	TBD	60%	TBD	80%	TBD	100%	TBD

## **DELTA FISH AGREEMENT EVALUATION, ACCEPTANCE, AND PROGRESS REVIEW OF MITIGATION ACTIONS**

The mitigation actions described in Attachment 2-Section A, B, C and D will be identified by DFG and DWR with assistance from USFWS and NMFS and submitted for final acceptance by DFG. The process for accepting, implementing and reviewing mitigation actions is as follows:

**A. Mitigation Action Development and Evaluation Process:**

1. Mitigation actions will be developed by DFG and DWR in cooperation with responsible regulatory agencies.
2. DFG and DWR shall evaluate each proposal following the guidelines set forth in Article I, Paragraph D.1 of the Agreement and the criteria set forth in Section B, below.
3. Proposed mitigation actions will be evaluated using the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) conceptual models and peer reviewed through the Ecosystem Restoration Program (ERP) Directed Action Process. (See ERP Directed Action flowchart below.)
4. Proposed mitigation actions will be submitted to the Delta Fish Agreement Advisory Committee for review and comment.
5. Proposed mitigation actions may be modified by input which includes but is not limited to that from the public, the Delta Fish Agreement Advisory Committee, or the DRERIP evaluation.
6. The finalized proposal will be submitted to DFG for acceptance of the proposed mitigation action.

**B. Criteria:** DFG will accept mitigation actions pursuant to the process described herein, using the following criteria, without limitation:

1. Aquatic habitat actions in the Delta and Suisun Marsh, primarily for the benefit of pelagic Fish Species, will focus on restoration of intertidal or shallow subtidal habitats. The acres of habitat restored or enhanced, as determined under Paragraph 3.A.1. of this Amendment are expected to provide both direct and indirect benefits by enhancing spawning and rearing habitat, increasing primary and secondary productivity in the Delta, and providing export of nutrients to adjacent openwater habitats. These habitat actions are expected to mitigate for productivity impacts which occur as a result of SWP Delta Pumping Facilities and

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support higher larval and juvenile fish survival and increased fitness of spawning adults by improving conditions for the production of forage species. Restored intertidal or shallow subtidal habitats will be expected to: a) provide net export of nutrients to adjacent open water (pelagic) habitat; b) have appropriate hydrodynamic and or salinity and water quality characteristics to minimize or discourage invasion by non-native submerged aquatic vegetation (e.g. *Egeria*) and *Microcystis* blooms; and/or c) function as spawning and/or rearing habitats for the Fish Species, and d) be located in areas not subject to the near-field effects of SWP Delta Pumping Facilities.

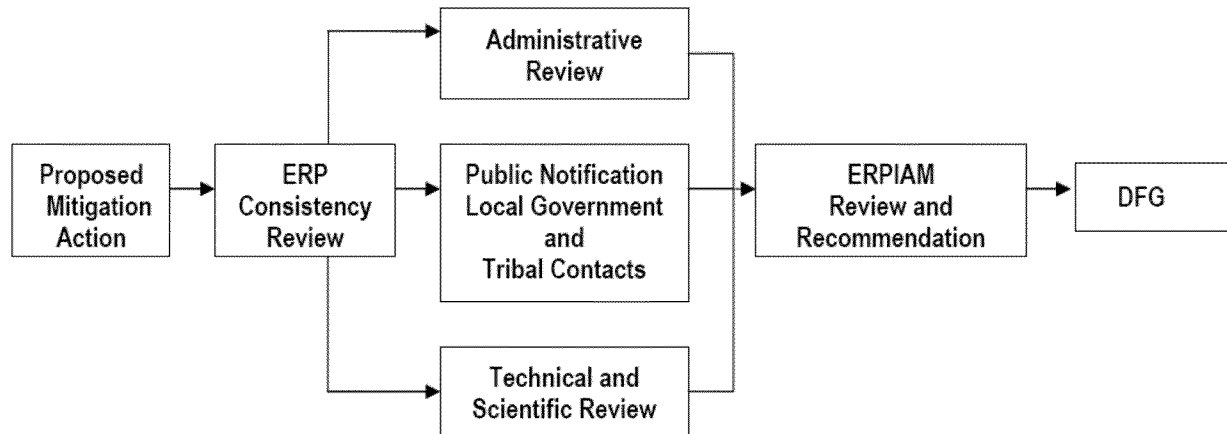
2. Mitigation actions primarily for the benefit of the salmonid Fish Species includes, a) provision of flows in tributary streams to enhance upstream passage, over-summering, spawning and rearing habitat, b) barrier removal which improves access to suitable habitat described above, and/or c) restoration of functional stream geomorphology and floodplain which provides spawning habitat and rearing habitat for out-migrating smolts. These actions are expected to increase available spawning habitat, improve over-summering adult survival, increase spawning success, and increase juvenile survival and fitness.

3. DFG will use its Habitat Management Land Acquisition Checklist to evaluate the acceptability of any property to be transferred as part of its consideration of the proposed mitigation action.

C. Review of Progress – DFG will monitor for the effectiveness of the mitigation actions towards meeting the criteria in Section B, as follows:

1. At Years Five and Eight of the Amendment, or earlier if necessary, the results of mitigation actions will be evaluated by an independent science panel or advisor as agreed to by DWR and DFG in order to determine if the mitigation actions are meeting intended mitigation criteria for Fish Species.
2. DFG, in coordination with DWR, will review implementation of mitigation actions after Year Four of the Amendment and each two years thereafter, to determine progress towards achieving mitigation acreage pursuant to Paragraph 3.F.2.a. of this Amendment.
3. If the review of progress indicates that mitigation actions are not performing adequately, DWR and DFG will implement adaptive management measures as necessary.

D. Ecosystem restoration program directed action flowchart:



E. Mitigation Acreage.

1. As part of its review and acceptance of each mitigation action, DFG will determine the amount of acreage to be credited. The amount of acreage credit will be based upon the criteria in Section B and the evaluation conducted in Section A.

2. For cost-share mitigation actions, acreage credit will be pro-rated based on DWR's funding contribution towards the implemented action. DFG will determine the pro-ration of acres by using the percentage of funding contributed towards the mitigation action by DWR through this Amendment. Or if the action contains distinct elements, DFG will credit the acreage of those elements to the extent funded by DWR through this Amendment. For each individual mitigation action, DFG will determine the appropriate method of pro-ration based on which method is more beneficial to the resource.

F. Other Mitigation Actions.

Notwithstanding the foregoing, DFG may accept proposals for mitigation from DWR without reference to the process and criteria set forth above, upon DFG first determining in its sole discretion that circumstances regarding the status of the Fish Species warrant such action. Such mitigation may include the funding of actions or the provision of assets, provided that DFG determines that the action or assets will provide mitigation benefit to the Fish Species. In the case of funding for a delta native fishes refugia facility, DFG would allow for an average funding up to \$1,500,000 per year in years 2 through 10 to be credited against DWR's habitat restoration requirements based on the E:I ratio, established in the final OCAP BiOps issued by the FWS and NMFS, determined pursuant to the process defined in Attachment 4, at \$20,000/acre. Reduction of acreage would be from the last year's commitments (Year 10). In addition

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DFG would consider other actions in exchange for habitat restoration up to a maximum of 10% of the total mitigation acreage required of DWR including any refugia funding. DFG will credit mitigation acreage to DWR for these other actions in the amount determined to correspond to the mitigation benefit provided. DFG will advise DWR of the amount of acreage to be credited prior to their taking action to implement the action.

### References

Kier, William M. and Michael B. Ward. January 1999. Battle Creek Salmon and Steelhead Restoration Plan.

Williams, John G. 2006. Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California. San Francisco Estuary and Watershed Science 4, no. 3 (December).

## California Department of Fish and Game Rationale for Effects of Exports<sup>1</sup>

### Introduction & Summary

This document describes the California Department of Fish and Game (DFG) methodology to quantify the surface area in the Sacramento – San Joaquin delta estuary (Delta) that is impacted by the operations of the State Water Project (SWP) and Central Valley Project (CVP) pumping facilities. In order to estimate the mitigation required to offset direct and indirect losses of Fish Species due to impacts to surface acres of aquatic habitat in the Delta accounted to the SWP Delta Pumping Facilities operations, DFG used an analysis based on conclusions and information contained in a manuscript that utilizes the Delta Simulation Model-2 Particle Tracking Model (DSM2-PTM) (Kimmerer and Nobriga, 2008). This methodology provides the general loss of “particles” to the Delta which is a surrogate for loss of productivity and fish life stages vulnerable to these effects.

Assuming a combined export E:I ratio of 0.35, the DFG analysis determined the amount of habitat restoration needed to offset the effects of SWP Delta exports is 12,076 surface acres of aquatic habitat. This is the acreage considered to be impacted as long as diversions continue at the SWP facilities at the identified assumed diversion rates. This analysis further assumes habitat for pelagic species includes open channel and other associated aquatic and intertidal areas that are utilized by various life history stages of pelagic fish species and for food production. The analysis uses flows that result in an E:I Ratio of 0.35 that occur during February 1- June 30, which is the E:I Ratio required by Decision 1641 during that time period. The DFG analysis identified the portion of water exported from the Banks Delta Pumping Plant to be approximately 55.18%<sup>2</sup> of combined Delta exports for the recent years of 2001 through 2006<sup>3</sup>

The actual E:I ratio used to determine the amount of aquatic habitat in the Delta and Suisun Marsh required by DFG as mitigation pursuant to this Amendment will be determined by the final OCAP BiOps and is expected to be between 0.17 and 0.35, depending on operational constraints. Therefore, based on the DFG analysis, the anticipated range of mitigation acreage would be between 8,047 and 12,076 acres.

The methodology described in this paper will be used to quantify the acreage to be acquired by the California Department of Water Resources (DWR) and managed to

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<sup>2</sup> DWR 2007. Table of Total Annual Exports at Banks and Bill Jones Pumping Plant 2001-2006 (from DWR Bulletin 132 and DWR Operations Control Office).

<sup>3</sup> This 55.18% includes the portion of CVP water exported through the SWP Banks Pumping Plant.

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mitigate impacts to Fish Species caused by the SWP Delta Pumping Facilities. The conclusions drawn here are independent of Kimmerer and Nobriga's conclusions and do not necessarily represent their views.

**The following assumptions were used in the Kimmerer and Nobriga paper:**

1) DSM2-PTM is an accurate model for Delta hydrodynamics; and 2) particles in the model are representative of pelagic larval Delta smelt. It should be noted that this paper analyzes the combined entrainment effects of both the SWP and CVP pumping facilities and does not attempt to differentiate the individual effects of either facility and assumes that the impacts are directly proportional. 3) The analysis assumed no flow barriers are operating in the Delta. 4) All in-Delta agricultural diversions set to winter values of  $0.9 \text{ m}^3 \text{ s}^{-1}$  for the model runs. See Nobriga et al. 2004 and Moyle and Israel 2005 for rationale.

The following is the abstract from “Investigating particle transport and fate in the Sacramento-San Joaquin Delta using a particle tracking model” [Kimmerer and Nobriga, 2008]:

Movements of pelagic organisms in the tidal freshwater regions of estuaries are sensitive to the movements of water. In the Sacramento-San Joaquin Delta, the tidal freshwater reach of the San Francisco Estuary, such movements are key to losses of fish and other organisms to entrainment in large water export facilities. We used the Delta Simulation Model-2 hydrodynamic model and its particle tracking model to examine the principal determinants of entrainment losses to the export facilities and how movement of fish through the Delta may be influenced by flow. We modeled 936 scenarios for 74 different conditions of flow, diversions, tides, and removable barriers to address seven questions regarding hydrodynamics and entrainment risk in the Delta. Tide had relatively small effects on fate and residence time of particles. Release location and hydrology interacted to control particle fate and residence time. The ratio of flow into the export facilities to freshwater flow into the Delta (export:inflow or EI ratio) was a useful predictor of entrainment probability if the model was allowed to run long enough to resolve particles' ultimate fate. Agricultural diversions within the Delta increased total entrainment losses and altered local movement patterns. Removable barriers in channels of the southern Delta and gates in the Delta Cross Channel in the northern Delta had minor effects on particles released in the rivers above these channels. A simulation of losses of larval delta smelt showed substantial cumulative losses depending on both inflow and export flow. A simulation mimicking mark-recapture experiments on Chinook salmon smolts suggested that both inflow and export flow may be important factors determining survival of salmon in the upper estuary. To the extent that fish behave passively, this model is probably suitable for describing delta-wide movement, but is less suitable for smaller scales or alternative configurations of the Delta.

## Methods and Results

A major effect of the pumps on the Delta can be explained by the Export to Inflow (E:I) ratio, which is the ratio of water export by the SWP and CVP pumping facilities and the amount of inflow into the Delta, or the fraction of inflow that is exported. While this is a simplification of the analysis done by Kimmerer and Nobriga the E:I ratio is a dominant factor in particle fate within the model given enough time for the model to run so that particle ultimate fate can be determined. As the E:I ratio increases (volume of exports nears the volume of inflow), the risk of entrainment increases for particles within the Delta as a whole. Conversely, as the E:I ratio decreases, entrainment risk decreases. Although there is risk due to exports across the entire Delta, the risk differs by release locations throughout the Delta, with risk generally diminishing with increasing distance from the south Delta diversions.

Kimmerer and Nobriga (2008) determined the probability that particles from each release location will be entrained into the SWP and CVP facilities and plotted entrainment risk for each particle release site against the likelihood that particles will be entrained based on calculations in the paper. Groups of locations with similar entrainment risk are color coded (Figure 1). The risk of entrainment increases as E:I ratio increases (Figure 2). These curves are logistic functions fit to the data points output from the particle tracking model. Sites with similar curves were grouped by Kimmerer and Nobriga to illustrate relative entrainment risk for particles from the release sites. These groupings are color coded according to the likelihood that particles will be entrained; green and light green being the lowest risk of entrainment, followed by orange, and then red being the highest. The DFG findings depart from the Kimmerer and Nobriga study on one point. Their analysis divided Franks Tract into the orange group on the east side and the green group on the west side. Recent investigations have suggested to DFG that there is significant tidal trapping effect in Franks Tract (Burau in press). The west side of Franks Tract has a single opening called False River. Particles are forced through False River on the high tide in the west (a narrow opening) into Franks Tract and then disperse into Franks Tract. On the ebb tide the effect is much different with a slow pull of diluted/mixed water downstream from Franks Tract towards the ocean. This is a result of the geometry of Franks Tract. Through reverse flows in Old and Middle Rivers, once a particle is in Franks Tract it has a clear path to the SWP and CVP pumps. For this reason, DFG placed both Franks Tract release sites in the red grouping for acreage purposes (Table 1, Figure 4). GIS software was used to find the acreages of the Delta channels represented by the release locations designated by the color groupings (Table 1, Figure 4).

The percent of particles entrained can be predicted by the logistic function:

$$f(x) = (1 - 1/(1 + a(e^{bx})))$$

where a and b are logistic parameters output from the model runs, and x is the E:I ratio in question.

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This function can be run for any E:I ratio and the estimated entrainment risk calculated. The results for an E:I ratio of 0.35 and 0.17 are shown in Table 3. For this analysis 0.35 is the E:I ratio of interest. Water Right Decision D-1641 sets an E:I ratio limit of 0.35 for the SWP/CVP for the months of February through June, with an exception in February following a very dry January. The 0.17 E:I ratio numbers are only shown for comparison purposes. These entrainment percentages (Table 3) were then averaged for locations within each color grouping (P) and these averages were multiplied by the channel surface area (Table 2) represented by that color group (A) to determine the extent of habitat affected (E, rounded to the nearest acre) (Table 4). The total habitat impacted, the sum of the color groups (E), by combined pumping of the SWP and CVP at an E:I ratio of 0.35 is shown in Table 4.

This is defined in the following area of effect equation:

$$A(P) = E$$

**Table 1. Release locations of particles and their relative entrainment risk (green = least entrainment risk, red = greatest). Color groups conform to Kimmerer and Nobriga, 2008, except for Frank's Tract west and Frank's Tract east.**

Green	Light Green	Orange	Red
Three Mile Slough (X3M)	Hood (Hoo)	N. Fork Mokelumne (NFM)	S. Fork Mokelumne (SFM)
Ryde (Ryd)	Twitchell Island (Twi)	Georgiana Slough (Geo)	Potato Slough (Pot)
Rio Vista (Rio)			Stockton (Sto)
Collinsville (Col)			Medford Island Med)
Antioch (Ant)			Victoria Canal (Vic)
			Vernalis (Ver)
			Bacon Island (Bac)
			Mossdale (Mos)
			Franks Tract West (FTW)
			Franks Tract East (FTE)

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**Table 2. Total acres for each zone. Term A for the previous equation is found in the second column.**

<b>Delta zone (color code)</b>	<b>Channel Area (acres)</b>
	<b>A</b>
Lower Sacramento (green)	19,140.69
Hood and West Delta San Joaquin (light green)	6,080.929
Georgiana / N. Fork Mokelumne (orange)	2,704.28
San Joaquin (red)	21,124.31
<b>Total</b>	<b>49,050.209</b>

**Table 3. Percent particle loss at SWP/CVP at indicated E:I ratio. Each loss color group is averaged to get the term P shown in Table 4.**

<b>Release Location</b>	<b>Loss at 35% E:I</b>	<b>Loss at 17% E:I</b>
Antioch	0.028898	0.008604
Collins	0.015794	0.004259
RioVis	0.074023	0.023395
Ryde	0.10951	0.035383
X3Mile	0.118093	0.0427
Hood	0.232942	0.093378
Twitch	0.241985	0.091961
GeoSlu	0.437069	0.166755
NFMok	0.438728	0.173957
Bacon	0.999986	0.926758
Franks103	0.463108	0.210794
Franks226	0.183297	0.076283
Medford	0.999135	0.68729
Mossdale	0.9992	0.911586
Potato	0.985028	0.479754
SFMok	0.860642	0.31332
Stockton	0.998728	0.685707
Vernalis	0.999364	0.920197
Victoria	1	1

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**Table 4. Impacted acres of Delta channels weighted by percent particle loss at E:I ratio of 0.35. This table shows the results of the equation  $A(P) = E$ . The total area of affect for this analysis is 21,885 acres.**

<b>Zone of Influence Totals</b>	<b>Acres</b>	<b>Average % Particle Loss</b>	<b>Acres of Loss</b>
	<b>A</b>	<b>P</b>	<b>E</b>
Sacramento (green)	19,140.69	0.06926321	1,326
West Delta San Joaquin (light green)	6,080.929	0.237463637	1,444
Georgiana / N. Fork Mokelumne (orange)	2,704.28	0.437898719	1,184
San Joaquin (red)	21,124.31	0.848848811	17,931
<b>Total</b>	<b>49,050.209</b>		<b>21,885</b>

### Discussion

Kimmerer and Nobriga indicate that this model may or may not be a good indicator for the entrainment of salmon smolts that are out-migrating because their behavior likely makes their fate depart substantially from neutrally buoyant particles. Salmon fry do enter the central Delta through the Delta Cross Channel and Georgiana Slough similarly to particles in the model and salmon smolt survival in the central delta is lower than in the mainstem of the Sacramento River (Brandes and McLain 2001). Fish that migrate through the central Delta incur higher mortality. Currently, juvenile Chinook salmon that enter the central Delta show lower survival rates than juveniles that stay in the main stem of the Sacramento River (Brandes and McLain 2001). The exact reasons for this are unknown: however local conditions such as predatory fish and changed hydrology are the most likely causes. Vogel (ERP 2004) showed that predation rates on Chinook salmon in Georgiana Slough were 82.1% verses the lower Sacramento main stem at 25%. Increased temperature in the central Delta where flows are low may also be a contributing factor in lowered survival of both salmon and delta smelt during certain times of the year.

However, for delta smelt larvae less than 20mm Kimmerer and Nobriga indicate that the particle tracking model provides good predictions for their movement, assuming that the underlying hydrodynamic model is accurate, and suggests that for the months of March through May measures could be taken to reduce their entrainment when E:I ratios are at 0.35 (D-1641). This analysis is also generally representative of pumping effects on longfin smelt in dry years when spawning and larval fish occur in the west and central Delta during similar time periods, although longfin smelt may appear 1-2 months (Dec. and Jan.) earlier when the E:I ratio is at 0.65. This analysis does not take into account the effect of the pumps on elements of delta smelt critical habitat in the

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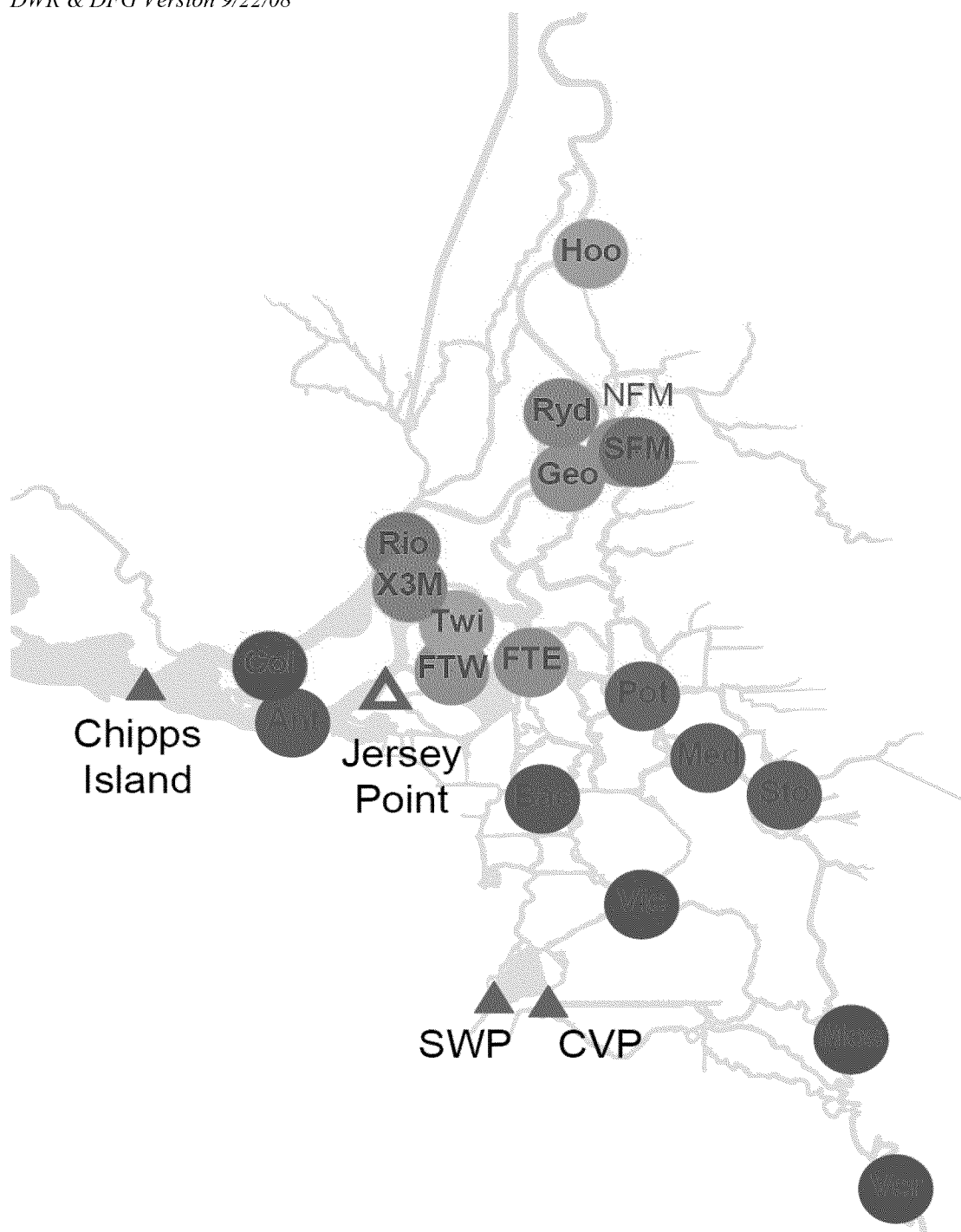
estuary such as nutrients, primary production, and secondary production. Primary production in Suisun Bay is dominated by allochthonous sources (Jassby 2008). The Delta is a net producer of organic matter to downstream areas in critically dry years (Jassby and Cloern 2000). However, the SWP/CVP facilities export a significant portion of this production and the resulting Delta transport of organic matter to Suisun Bay is less than what enters from upstream sources like the San Joaquin River (Jassby and Cloern 2000). An examination of habitat reduction due to the export of water and nutrients from the system would help to quantify the effect of the SWP/CVP diversions on populations of native fish.

### Conclusion

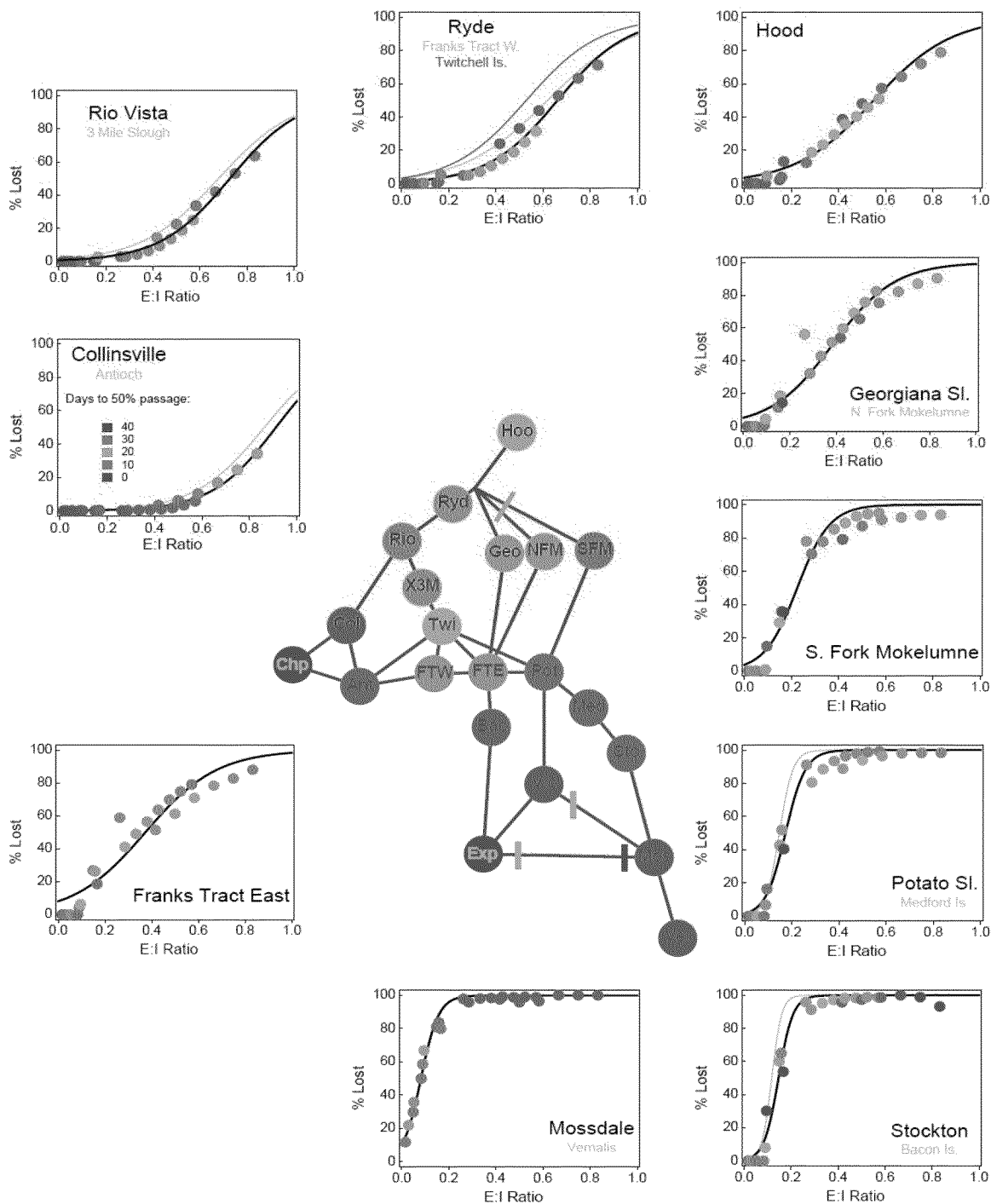
From this analysis, DFG has determined that the total amount of Delta wetlands affected by the CVP and SWP pumping activities is 21,885 acres of marsh while pumping rates are at a 0.35 E:I ratio.

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**Figure 1. This figure shows release locations and their grouping by entrainment risk according to Kimmerer and Nobriga (from Kimmerer and Nobriga, 2008, figure 1).**



**Figure 2. Logistic curve fits to the particle tracking entrainment data. E:I ratio is on the x axis and percent lost to pumping is on the y axis. (from Kimmerer and Nobriga, 2008, figure 7).**

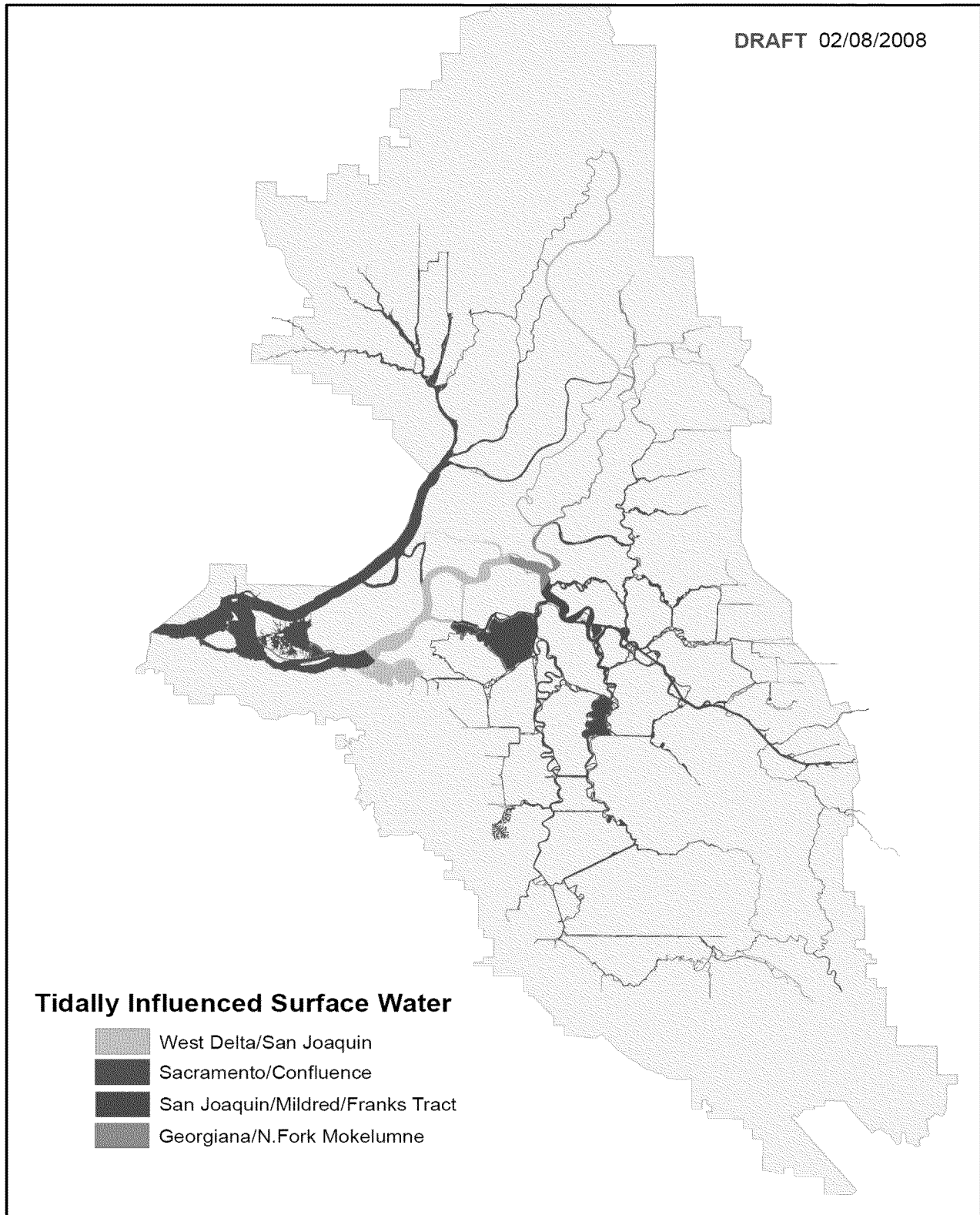


Figure 3. Area of effect as defined by entrainment risk and GIS software (DFG).